

REMARKS

Applicants respectfully request entry of the amendment and reconsideration of the claims. Claim 19 has been amended. Claims 7, 13, and 20-24 have been cancelled without prejudice or disclaimer. After entry of the amendment, claims 3 and 8-19 will be pending. Claims 15, 16, and 18 have been withdrawn by the Examiner as directed to a non-elected invention.

Applicants submit the amendment to claim 19 is supported throughout the specification and does not introduce new matter. Ionic conductivity of 0.071 S/cm is supported by the specification, for example, at page 20, lines 13-15 and Table 1. A characteristic factor of $54 \Omega^{-1} \text{cm}^{-3} \text{s}$ or more is supported by the specification, for example, at page 22, line 7 to page 23, line 6 and Fig. 3. Equation 1 at page 22 of the specification provides an equation for calculating the characteristic factor (characteristic factor = (ionic conductivity/methanol permeability) $\times 10^{-3}$). A characteristic factor of $54 \Omega^{-1} \text{cm}^{-3} \text{s}$ is calculated from Equation 1 at page by substituting 0.091 S/cm in Table 1 as the ionic conductivity in Equation 1 and $1.68 \times 10^{-6} \text{ cm}^2/\text{sec}$ in Table 2 as the methanol permeability in Equation 1. Fig. 3 shows that the composite membranes have a characteristic factor of $54 \Omega^{-1} \text{cm}^{-3} \text{s}$ (Embodiment 1 which is represented as 100A) or more (see 300A, 500A, 700A, and 900A in Fig. 3).

35 U.S.C. § 112

Claim 24 was rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement and under U.S.C. § 112, second paragraph, as being indefinite. Without acquiescing to the rejections and solely for the purpose of advancing prosecution, claim 24 has been canceled without prejudice or disclaimer. Applicants reserve the right to pursue the canceled subject matter in a continuing application. Withdrawal of the rejections is respectfully requested.

35 U.S.C. § 103

(1) Claim 13 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu in view of Debe, and Morosanu and further in view of Nomura and Ozeki (WO2002/0114958).

Applicants respectfully traverse this rejection.

As an initial matter, it is noted that the limitations of claim 13 (regarding the thickness of the inorganic thin film) have been incorporated into claim 19. Therefore, the rejection is addressed below insofar as it applies to amended claim 19.

Second, the Office Action at page 5 acknowledges that the combination of Ohzu, Debe, Morosanu, and Nomura does not disclose or suggest the thickness of the inorganic thin film as recited in the claims, but alleges it would have been obvious to make an inorganic thin film according to Ohzu with a thickness of 500nm or less as disclosed by Ozeki in order to provide a uniform coating on the polymer membrane while avoiding the formation of cracks in the coating layer. Applicants do not agree.

“A rejection cannot be predicated on the mere identification . . . of individual components of the claimed invention.” *Ecolchem Inc. v. Southern Calif. Edison Co.*, 227 F.3d 1361, 1375 (Fed. Cir. 2000). Rather, a prior art reference must be considered in its entirety, including portions that would lead away from the claimed invention. See MPEP § 2141.02 citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir. 1983) *cert. denied*, 469 U.S. 851 (1984). Particular findings must be made in view of the entire teachings of the prior art references(s) as to the reason the skilled artisan, with no known knowledge of the claimed invention, would have selected these components for combination in the manner claimed.

The physical properties of the glass film disclosed in Ohzu are different from that of the claims. As discussed in the response filed July 10, 2009, the inorganic glass film disclosed by Ohzu is made by a “sol-gel” method which is distinctive from the PECVD method recited in the

claims. See, for example, Ohzu at col.4 line 66~67 and Examples 1-9. As the method for manufacturing the inorganic glass film of Ohzu is different from that of the present invention, the thickness of the final product made thereby is also different. The thickness of the thin films is an important factor in the structure of the thin films. While the inorganic thin film of the present invention has a thickness of 1.0 to 500 nm, it is difficult to prepare thin films of nanometer thickness using the sol-gel method disclosed in Ohzu due to structural distortion, breaks, cracks, and shrinkage of the thin films which occur during the drying process of the sol-gel method. In fact, the glass film disclosed in Ohzu has a thickness of about 30 microns (Ohzu at Example 1) or a thickness of about 20 microns (Ohzu at Examples 2 and 3) which is approximately 60-30,000 times thicker than the thin films of the present invention.

Third, the structure implied by process steps should be considered when assessing patentability where the manufacturing steps would be expected to impart distinctive structural characteristics to the final product. MPEP § 2113. Similar to Ohzu, Ozeki does not disclose or suggest coating the surface of a composite membrane for a fuel cell with an inorganic thin film as recited in the claims using PECVD. Therefore, the manufacturing steps recited in the claims impart distinctive structural characteristics with respect to physical structure and thickness of the composite membrane.

In this regard, claim 19 has been amended to further recite that the composite membranes have an ionic conductivity of at least 0.071 S/cm and a characteristic factor of at least $54 \Omega^{-1} \text{cm}^{-3} \text{s}$. The cited combination of references does not disclose or suggest such composite membranes.

The combination of Ohzu, Debe, Morosanu, and Nomura does not disclose or suggest composite membranes for a fuel cell having an ionic conductivity of 0.071 S/cm or more. The electrolyte membranes disclosed by Ohzu have an ionic conductivity of 5×10^{-3} S/cm (Ohzu at Examples 6, 7 and 9) or 2×10^{-4} S/cm (Ohzu at Example 8). The ionic conductivity of the electrolyte membranes disclosed by Ohzu is significantly lower than that of the claimed composite membranes. The minimum ionic conductivity 0.071 S/cm of composite membranes

produced according to the claims is about 14 times (0.071 S/cm divided by $5 \times 10^{-3} \text{ S/cm}$) to about 355 times (0.071 S/cm divided by $2 \times 10^{-4} \text{ S/cm}$) higher than the ionic conductivity of the electrolyte membranes disclosed by Ohzu. As the inorganic glass film of Ohzu is much thicker than that of the present invention, the ionic conductivity of the electrolyte membranes coated with the inorganic glass film prepared by the sol-gel method is significantly low.

The combination of Ohzu, Debe, Morosanu, and Nomura also does not disclose or suggest composite membranes for a fuel cell having a characteristic factor of $54 \Omega^{-1} \text{ cm}^{-3} \text{ s}$ or more. A characteristic factor of at least $54 \Omega^{-1} \text{ cm}^{-3} \text{ s}$ means that the methanol permeability of the composite membrane is decreased sizably while the ionic conductivity is decreased only by a small amount, and thus the performance of a direct methanol fuel cell comprising a composite membrane of the invention can be enhanced and the life of the cell can be extended. See, for examples, the specification at page 24, line 9 to page 25, line 1.

Fourth, Ozeki does not cure the deficiencies of the combination of Ohzu, Debe, Morosanu, and Nomura. More specifically, Ozeki does not disclose or suggest an inorganic thin film coating on a polymer electrolyte membrane. Ozeki only discloses zeolite film and not an inorganic thin film made by using one or more organic metal compound(s) chosen from the group comprising trimethyl disiloxanes (TMDSO), hexamethyl disilane, tetramethyl orthosilicate, tetrabutyl orthosilicate, tetraisopropyl orthosilicate, aluminium methoxide, aluminium ethoxide, aluminium butoxide, aluminium isopropoxide, titanium ethoxide, titanium methoxide, titanium butoxide, titanium isopropoxide, zirconium ethoxide, and zirconium butoxide as reactants, in conjunction with one or more gases out of the group of nitrogen, hydrogen, steam, and argon.

Further, the zeolite coating disclosed in Ozeki is distinctive from the inorganic thin film, which is made of one of more selected from the group consisting of silicon oxide (SiO_2), titanium oxide (TiO_2), zirconium oxide (ZrO_2), zirconium phosphate ($\text{Zr}(\text{HPO}_4)_2$), silicalite, and aluminum oxide (Al_2O_3). The Office Action has not provided any evidence or reasoning which

establishes that the zeolite coating of Ozeki includes all kinds of inorganic thin films, much less the inorganic thin films specifically recited in the claims; that the zeolite coating method of Ozeki can be applied to all kinds of inorganic films, much less the inorganic thin films specifically recited in the claims; or that a composite membrane comprising the zeolite film of Ozeki would have an ionic conductivity of at least 0.071 S/cm and a characteristic factor of at least $54 \Omega^{-1} \text{cm}^{-3} \text{s}$.

In view of the foregoing, Applicants submit the Office Action has failed to make the required *prima facie* case of obviousness since the cited combination of Ohzu, Debe, Morosanu, Nomura, and Ozeki does not disclose or suggest all the elements of the claims as amended and lack sufficient reason to combine. Withdrawal of the rejection is respectfully requested.

(2) Claims 3, 8, 9, 17, and 19 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu (U.S. 6,416,898) in view of Debe (U.S. 5,879,828) and Morosanu and further in view of Nomura (U.S. 5,439,736). Applicants respectfully traverse this rejection.

Without acquiescing to the rejection and solely for the purpose of advancing prosecution, the limitations of claim 13 regarding the thickness of the inorganic thin film have been incorporated into claim 19. The Office Action at page 5 acknowledges that the combination of Ohzu, Debe, Morosanu, and Nomura does not disclose or suggest the thickness of the inorganic thin film as recited in the claims. The rejection is therefore moot.

Withdrawal of the rejection is requested.

(3) Claims 10-12 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu in view of Debe, and Morosanu and further in view of Nomura and Izu (U.S. 5,670,224). Applicants respectfully traverse this rejection.

Claims 10-12 depend from claim 19. The combination of Ohzu, Debe, Morosanu, and Nomura does not disclose or suggest all the elements of claim 19 as amended for the reasons discussed above. Izu does not cure the deficiencies of Ohzu, Debe, Morosanu, and Nomura. The combination of Ohzu, Debe, Morosanu, Nomura, and Izu does not disclose or suggest all the elements of claim 19 as amended, or of claims 10-12 which depend from claim 19.

In view of the foregoing, Applicants submit the cited combination of references fails to disclose or suggest all the elements of claims 10-12. Withdrawal of the rejection is respectfully requested.

(4) Claim 14 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu in view of Debe, and Morosanu and further in view of Nomura and Zuber (U.S. 6,156,449). Applicants respectfully traverse this rejection.

Claim 14 depends from claim 19. The combination of Ohzu, Debe, Morosanu, and Nomura does not disclose or suggest all the elements of claim 19 as amended for the reasons discussed above. Zuber does not cure the deficiencies of Ohzu, Debe, Morosanu, and Nomura. The combination of Ohzu, Debe, Morosanu, Nomura, and Zuber does not disclose or suggest all the elements of claim 19 as amended, or of claim 14 which depends from claim 19.

In view of the foregoing, Applicants submit the cited combination of references fails to disclose or suggest all the elements of claim 14. Withdrawal of the rejection is respectfully requested.

(5) Claims 7 and 20-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu in view of Sproul (U.S. 5,789,071). Without acquiescing to the rejection and solely for the purpose of advancing prosecution, claims 7 and 20-22 have been canceled without prejudice or disclaimer. Applicants reserve the right to pursue the canceled subject matter in a continuing application. Withdrawal of the rejection is requested.

(6) Claim 23 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohzu in view of Sproul and further in view of Izu. Without acquiescing to the rejection and solely for the purpose of advancing prosecution, claim 23 has been canceled without prejudice or disclaimer. Applicants reserve the right to pursue the canceled subject matter in a continuing application. Withdrawal of the rejection is requested.

Conclusion

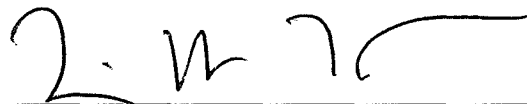
In view of the above amendments and remarks, Applicants respectfully request a Notice of Allowance. Applicants do not otherwise concede the correctness of the rejections and reserve the right to make additional arguments as may be necessary. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.

Please consider this a PETITION FOR EXTENSION OF TIME for a sufficient number of months to enter these papers or any future reply, if appropriate. Please charge any additional fees or credit overpayment to Deposit Account No. 13-2725.

Respectfully submitted,

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